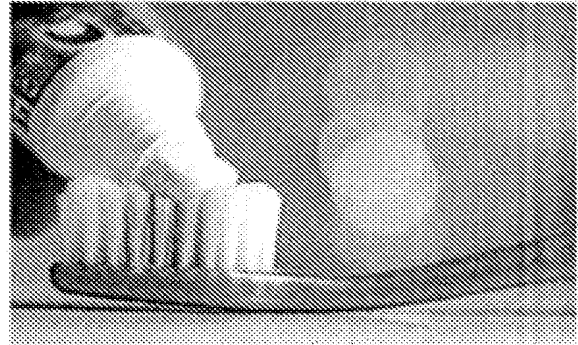


# Toothpaste

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**Toothpaste** is a paste or gel dentifrice used with a toothbrush to clean and maintain the aesthetics and health of teeth. Toothpaste is used to promote oral hygiene: it can aid in the removal of dental plaque and food from the teeth, aid in the elimination and/or masking of halitosis and deliver active ingredients such as fluoride or xylitol to prevent tooth and gum disease (gingivitis). Some dentist recommendations include brushing your teeth at least twice a day, if not more. In most or all developed countries, usage after each meal is encouraged by dentists. However when cleaning teeth with a toothbrush with toothpaste, the essential cleaning is done by the mechanical brushing, and not by the active toothpaste chemicals.



Toothpaste from a tube being applied to a toothbrush

Most toothpaste contains trace amounts of chemicals which may be toxic when ingested; it is not intended to be swallowed.

## Contents

- 1 History
  - 1.1 Early toothpastes
  - 1.2 Tooth powder
  - 1.3 Modern toothpaste
- 2 Ingredients and flavors
  - 2.1 Active ingredients
  - 2.2 Other ingredients
- 3 Critics
  - 3.1 Toxicity
  - 3.2 Environmental and health concerns
- 4 Striped toothpaste
- 5 See also
- 6 Notes
- 7 External links

## History

### Early toothpastes

The earliest known reference to toothpaste is in a manuscript from Egypt in the 4th century A.D., which prescribes a mixture of iris flowers. However, toothpastes or powders did not come into general use until the 19th century. The Greeks, and then the Romans, improved the recipes for toothpaste by adding abrasives such as crushed bones and oyster shells.<sup>[1]</sup> In the 9th century, the Persian musician and fashion designer Ziryab is known to have invented a type of toothpaste, which he popularized throughout Islamic Spain.<sup>[2]</sup> The exact ingredients of this toothpaste are currently

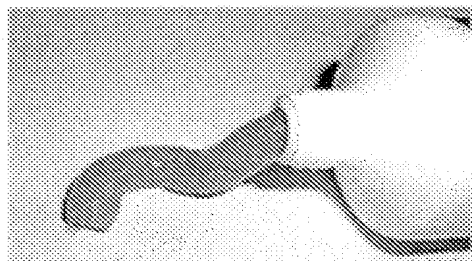
unknown,<sup>[3]</sup> but it was reported to have been both "functional and pleasant to taste".<sup>[2]</sup> It is not known whether these early toothpastes were used alone, were to be rubbed onto the teeth with rags, or were to be used with early toothbrushes such as neem tree twigs or *miswak*. It is known that these twigs were used by Indians from ancient times. Neem tree twigs are said to have good medicinal effects.

## Tooth powder

Tooth powders for use with toothbrushes came into general use in the 19th century in Britain. Most were homemade, with chalk, pulverized brick, or salt as ingredients. An 1866 Home Encyclopedia recommended pulverized charcoal, and cautioned that many patented tooth powders that were commercially marketed did more harm than good. Recently, homemade tooth powders are made by mixing 3 parts baking soda (cleanser) thoroughly with 1 part salt (the abrasive).<sup>[4]</sup>

A homemade version of toothpaste can be made by mixing 3 parts baking soda and 1 part salt with: 3 teaspoons of glycerin, 10-20 drops of flavoring and 1 drop of food coloring.<sup>[5]</sup>

## Modern toothpaste



Modern toothpaste gel

An 18th century American and British toothpaste recipe containing burnt bread has been found. Another formula around this time called for dragon's blood (a resin), cinnamon, and burnt alum.<sup>[6]</sup>

By 1900, a paste made of hydrogen peroxide and baking soda was recommended for use with toothbrushes. Pre-mixed toothpastes were first marketed in the 19th century, but did not surpass the popularity of tooth-powder until World War I. In 1892, Dr. Washington Sheffield of New London, Connecticut, manufactured toothpaste into a

collapsible tube. Sheffield's toothpaste was called Dr. Sheffield's Creme Dentifrice. He had the idea after his son traveled to Paris and saw painters using paint from tubes. In New York City in 1896, Colgate & Company Dental Cream was packaged in collapsible tubes imitating Sheffield.

Fluoride was first added to toothpastes in 1914, and was criticized by the American Dental Association (ADA) in 1937. Fluoride toothpastes developed in the 1950s received the ADA's approval. To develop the first ADA-approved fluoride toothpaste, Procter & Gamble started a research program in the early 1940s. In 1950, Procter & Gamble developed a joint research project team headed by Dr. Joseph Muhler at Indiana University to study new toothpaste with fluoride. In 1955, Procter & Gamble's Crest launched its first clinically proven fluoride toothpaste. On August 1, 1960, the ADA reported that "Crest has been shown to be an effective anticavity (decay preventative) dentifrice that can be of significant value when used in a conscientiously applied program of oral hygiene and regular professional care." Countries limit and suggest different amounts of fluoride acceptable for health. Much of Africa has a slightly higher percentage than the U.S.

In June, 2007, the US Food and Drug Administration and similar agencies in Panama, Puerto Rico and Australia advised consumers to avoid certain brands of toothpaste manufactured in China, after some were found to contain the poisonous diethylene glycol, also called diglycol or labeled as "DEG" on the tube. The chemical is used in antifreeze as a solvent and is potentially fatal.<sup>[7]</sup>

## Ingredients and flavors

## Active ingredients

Fluoride in various forms is the most popular active ingredient in toothpaste to prevent cavities. Although it occurs in small amounts in plants, animals, and some natural water sources, and has effects on the formation of dental enamel and bones, it is not considered to be a dietary essential and no deficiency signs are known. Sodium fluoride (NaF) is the most common form; some brands use sodium monofluorophosphate ( $\text{Na}_2\text{PO}_3\text{F}$ ) or olaflur. Much of the toothpaste sold in the United States has 1000 to 1100 parts per million fluoride ion from one of these active ingredients, in the UK the fluoride content is often higher, a NaF of 0.32% w/w (1,450 ppm fluoride) is not uncommon. This consistency leads some to conclude that cheap toothpaste is just as good as expensive toothpaste. When the magazine Consumer Reports rated toothpastes in 1998, 30 of the 38 were judged excellent. Application of fluoride also prevents moisture build-up in some surfaces. Other ingredients are less commonly used, including Hydroxyapatite nanocrystals and calcium phosphate for remineralization, [8] and strontium chloride or potassium nitrate to reduce sensitivity.

## Other ingredients

In addition to fluoride, the other fundamental ingredient in most toothpastes is an abrasive. Studies have shown that abrasives in toothpaste reduce the time needed to remove plaque from the teeth by approximately 50%. Abrasives, like the dental polishing agents used in dentist's offices, also cause a small amount of enamel erosion which is termed "polishing" action. Some brands contain powdered white mica which acts as a mild abrasive, and also adds a cosmetically-pleasing glittery shimmer to the paste. Many may contain frustules of dead diatoms as a mild abrasive. The removal of plaque and calculus prevents caries and periodontal disease. The polishing of teeth removes stains from tooth surfaces, but has not been shown to improve dental health over and above the effects of the removal of plaque and calculus.

Many, though not all, toothpastes contain sodium lauryl sulfate (SLS) or another of the sulfate family. SLS is found in other personal care products as well, such as shampoo, and is largely a foaming agent although it also acts as a powerful antimicrobial. Due to the anionic charge of SLS, mouthwashes containing cetylpyridinium chloride (which has a cationic charge and thus neutralises SLS) should not be used straight after brushing. SLS may cause a greater frequency of mouth ulcers in some people as it can dry out the protective layer of oral tissues causing the underlying tissues to become damaged[1].

Ingredients such as baking soda, enzymes, vitamins, herbs, calcium, calcium sodium phosphosilicate, mouthwash, and/or hydrogen peroxide are often combined into base mixes and marketed as being beneficial. Some manufacturers add antibacterial agents, for example triclosan or zinc chloride, to prevent gingivitis. Triclosan is a common ingredient in the UK. Bases such as sodium hydroxide are also used to neutralize acids.

Toothpaste comes in a variety of colorings, and flavors. The more usual flavorings are some variation on mint (spearmint, peppermint, regular mint, etc). Other more exotic flavors include: anise, apricot, bubblegum, cinnamon, fennel, lavender, neem, ginger, vanilla, lemon, orange, pine. More unusual are flavors include peanut butter, iced tea, and even whisky. Unflavored toothpaste does exist, however, most are flavored and sweetened. Because sugar promotes growth of bacteria that cause tooth decay, artificial sweeteners such as sorbitol or saccharin are generally used instead. The inclusion of sweet-tasting but toxic diethylene glycol in Chinese-made toothpaste led to a multi-



Toothpaste is sold in many brands

nation and multi-brand toothpaste recall in 2007.

## Critics

### Toxicity

With the exception of toothpaste intended to be used on pets such as dogs and cats, and toothpaste used by astronauts, most toothpaste is not intended to be swallowed, and doing so may cause nausea or diarrhea; fluoride toothpaste can be toxic if swallowed in large amounts. If a large amount of toothpaste is swallowed, Poison Control should be contacted immediately.<sup>[9]</sup> Extended consumption while the teeth are forming can result in fluorosis. This is why young children should not use fluoride toothpaste except under close supervision. There are several non-fluoride toothpaste options available in the market for those who choose not to use fluoride. Natural toothpaste can contain peppermint oil, myrrh, plant extract(strawberry extract), special oils and cleansing agents. Case reports of plasma cell gingivitis have been reported with the use of herbal toothpaste containing cinnamon.<sup>[10]</sup>

### Environmental and health concerns

Several of the ingredients in toothpastes are found by some environmentally damaging or hazardous to the personal health. These ingredients include<sup>[11]</sup>:

- Fluoride
- Artificial flavoring
- Artificial colors
- Triclosan
- Sodium bicarbonate (baking soda)
- Detergents
- Binding agents
- Humectants
- Preservatives such as Methylparaben and Ethylparaben-parabens
- Pyrophosphate
- Potassium nitrate
- Sodium lauroyl sarcosinate
- Polyethylene glycol
- Polypropylene glycol
- Sodium saccharin/aspartame

Fluoride, while required in toothpastes endorsed by the American Dental Association, does pose some health issues, namely enamel fluorosis, which can affect children at age eight and younger. Enamel fluorosis is an excess mineral deposit of fluoride on developing enamel. Triclosan is found a registered pesticide, is used as an antibacterial and antifungal agent and can destroy fragile aquatic ecosystems. The preservatives family of Methylparaben and Ethylparaben-parabens (which includes methyl-, ethyl-, propyl- and butyl-parabens) can affect the endocrine system which produces the body's hormones. Potassium nitrate is also an aquatic environmental nasty, parabens can disrupt the hormones in animals. Lauryl sarcosinate foaming and cleansing agents are found in most soaps, shampoos and toothpastes. Serious allegations of SLS's adverse health affects abound, though reputable sources such as the American Cancer Society have challenged the accusations Sodium saccharin/aspartame sweeteners such as sodium saccharin are added for taste. Other flavors are usually strong essential oils in the mint family.

As a direct result of these concerns, some people have started making their own tooth paste instead, which -while still not completely ecologic due to the use of baking soda- still eliminates much

environmentally or health damaging ingredients. Also, commercial toothpastes are made which are less or even non-environmentally damaging. Such preparations are eg made from herbal resins, propolis and myrrh <sup>[12]</sup><sup>[13]</sup>

## Striped toothpaste



The red area represents the material used for stripes, and the rest is the main toothpaste material. The two materials are not in separate compartments; they are sufficiently viscous that they will not mix. Applying pressure to the tube causes the main material to issue out through the pipe. Simultaneously, some of the pressure is forwarded to the stripe-material, which is then pressed onto the main material through holes in the pipe.

Striped toothpaste was invented by a New Yorker named Leonard Lawrence Marraffino in 1955. The patent (US patent 2,789,731, issued 1957) was subsequently sold to Unilever, who marketed the novelty under the 'Stripe' brand-name in the early 1960s. This was followed by the introduction of the 'Signal' brand in Europe in 1965 (UK patent 813,514). Although 'Stripe' was initially very successful, it never again achieved the 8% market share that it cornered during its second year.

Marraffino's design, which remains in use for single-color stripes, is simple. The main material, usually white, sits at the crimp end

of the toothpaste tube and makes up most of its bulk. A thin pipe, through which that carrier material will flow, descends from the nozzle to it. The stripe-material (this was red in 'Stripe') fills the gap between the carrier material and the top of the tube. The two materials are not in separate compartments. The two materials are sufficiently viscous that they will not by-chance mix with the other material. When pressure is applied to the toothpaste tube, the main material squeezes down the thin pipe to the nozzle. Simultaneously, the pressure applied to the main material causes pressure to be forwarded to the stripe material, which then issues out through small holes (in the side of the pipe) onto the main carrier material as it is passing those holes.

In 1990 Colgate-Palmolive was granted a patent (USPTO 4,969,767) for two differently-colored stripes. In this scheme, the inner pipe has a cone-shaped plastic guard around it, and about half way up its length. Between the guard and the nozzle-end of the tube is then a space for the material for one color, which then issues out of holes in the pipe. On the other side of the guard is space for second stripe-material, which has its own set of holes.

Striped toothpaste should not be confused with layered toothpaste. Layered toothpaste requires a multi-chamber design (e.g. USPTO 5,020,694), in which two or three layers then extrude out of the nozzle. This scheme, like that of pump dispensers (USPTO 4,461,403), is more complicated (and thus, more expensive to manufacture) than either the Marraffino design or the Colgate design.

## See also

- Tooth whitening
- Dental floss
- Fluoride therapy
- Sodium dodecyl sulfate
- Toothbrush
- Creamy snuff
- Toothpaste tube theory

## Notes

- <sup>^</sup> The History of Toothpaste and Toothbrushes
- <sup>^</sup> <sup>*a b*</sup> Sertima, Ivan Van (1992), *The Golden Age of the Moor*, Transaction Publishers, p. 267, ISBN

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9. ^ Canedy, Dana (1998-03-24), *Toothpaste a Hazard? Just Ask the F.D.A.*, *New York Times*, <http://query.nytimes.com/gst/fullpage.html?sec=health&res=9406E2D81338F937A15750C0A96E958260>, retrieved 2008-12-21
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11. ^ Possible environmental and health-risking ingredients
12. ^ Ecological commercial toothpaste recipe
13. ^ List of commercial environmental toothpaste companies

## External links

- Fluoride toothpaste history

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Categories: Dentifrices | Oral hygiene | Teeth | Oral pathology | Brands of toothpaste

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